Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), JULY 2022
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code : **20EET204**

Course Name: **Electromagnetic Theory**

Max. Marks : **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Describe the concept of gradient of scalar field. Derive its expression.
2. State and explain Stoke's Theorem.
3. What is an equipotential surface? What are its properties.
4. Explain Laplace and Poison equation and mention its significance.
5. Differentiate between scalar magnetic potential and vector magnetic potential.
6. With the help of Ampere's circuital law, derive an expression for magnetic field intensity at a point around a current carrying conductor.
7. Explain skin effect in conductors. With the help of expression, explain how it is varied with respect to frequency?
8. Distinguish between phase and group velocity.
9. Define transmission line parameters with the help of equivalent circuit.
10. Define standing wave ratio. Write an expression of SWR related with reflection coefficient.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Describe divergence of vector and its physical significance. Derive an expression for divergence of vector in cartesian coordinate system. (7)
    b) Convert the points A (3,1,-2) into spherical and cylindrical coordinate system with neat diagram. (7)

OR

12. a) Derive the expression of rectangular coordinate system vectors in terms of cylindrical coordinate vectors (7)
    b) Flux density over the surfaces is given by D=$\rho^2 cos^2\Phi\ \hat{a}_\rho + z\ sin\Phi\ \hat{a}_\Phi$,Verify Divergence theorem if the charges are enclosed by a cylinder of radius 4 m, $0 \leq z \leq 1$ m (7)

MODULE II

13. a) State Gauss's law. Using Gauss's law, derive an expression for electric field intensity due to a infinite line charge. (10)
    b) With neat diagram derive an expression for capacitance of co axial cable. (4)

OR

14. a) Two point charges Q_1=50 μC and Q_2=10 μC are located at (-1,1,-3)m and (3,1,0) m respectively. With figure, find the force on Q_1? (5)
    b) With neat figure, derive the expression of electric field at a point (0,0,z) due to circular ring of radius ρ carrying uniform charge density ρ_L C/m placed in XY plane. (9)

MODULE III

15. a) Derive the electrostatic boundary conditions at the interface between two perfect dielectrics. (6)
    b) Explain Biot-Savart's law and also represent magnetic field intensity in integral form. Derive magnetic field intensity due to infinitely long straight conductor. (8)

OR

16. a) Explain Maxwell's equations and also represent in integral and differential form. Also mention the laws from which equations are derived. (8)
    b) Derive continuity equation and write an expression for relaxation time. (6)

MODULE IV

17. a) Explain Poynting theorem and derive an expression for complex Poynting vector. (8)
    b) Derive the expression for attenuation constant and phase constant of propagated waves in loss-less dielectric medium. (6)

OR

18. a) Derive the wave equations for wave propagating in a lossy dielectric medium. (7)
    b) A lossy dielectric has an intrinsic impedance of 200<30° Ω at a particular frequency. The plane wave propagating through the dielectric medium with the magnetic field component H= 10 $e^{-\alpha x}\cos(wt - 0.5x)\,\widehat{a_y}$. A/m
    Find i) Expression of E- field . (7)
    ii) Attenuation constant
    iii) Value of skin depth
    iv) Find phase velocity if f= 700 MHz

MODULE V

19. a) With help of equivalent circuit of a transmission line, derive the standard transmission line equations and its solution. (8)
    b) A transmission line has R=30 Ω/km, L=100 mH/km, G=0 and C= 20μF/km. Wave at a frequency of 1 kHz, calculate the characteristic impedance and propagation constant. (6)

OR

20. a) Derive an expression of Zo, for a distortion less and lossless transmission line. (6)
b) A transmission line of length 0.2 λ and characteristic impedance 100 Ω is terminated with a load impedance of 50+200j. Find reflection coefficient at load end, VSWR and input impedance. (8)

****